LEAD SCREW NUT DEVICE

BACKGROUND

[0001] Lead screw nut devices can have clearance between the threads of the nut and the lead screw, which can result in noise and positional precision issues.

SUMMARY OF THE INVENTION

[0001a] Aspects of the invention are defined in the independent claims. Some optional features of the invention are defined in the dependent claims.

[0002] As disclosed herein, there is provided a centralizing bushing device or assembly which can be used with lead screw nut devices for centralizing the lead screw shaft and damping noise. The centralizing bushing assembly can include a bushing housing having axial ends and an opening extending therethrough along an axial axis. The opening can have a pocket or chamber extending outwardly from the axial axis within the bushing housing and have internal or inner shoulders or walls axially facing each other. A bushing or centralizer ring can be positioned within the pocket of the bushing housing between the internal shoulders. The bushing ring can have a split or gap for allowing collapsing of the bushing ring radially inward and have an inner diameter for slidably engaging an axially movable shaft extending through the bushing housing along the axial axis and also have an outer shoulder. A resilient biasing member can be positioned against the outer shoulder of the bushing ring for radially biasing the inner diameter of the bushing ring radially inwardly in a centralizing manner about the axial axis for engaging and centralizing the shaft slidably positioned therethrough.

[0003] In particular embodiments, the opening through the bushing housing can include a smaller diameter hole connected to the pocket which has a larger diameter. The resilient biasing member can be a resilient vibration damping O-ring. The pocket within the bushing housing can have an angled internal surface which biases the O-ring both radially inwardly and axially, for biasing the inner diameter of the bushing ring radially inwardly, and for biasing the bushing ring axially against one internal shoulder. A lead screw shaft can extend through the bushing housing and threadably engage a threaded lead nut within the smaller diameter hole. The bushing housing can be a nut body having a lead nut. The bushing ring can resiliently engage outer surfaces of the lead screw for centering the lead screw relative to the threaded nut for proper contact therebetween and damping noise. The pocket can be located at one axial end of the bushing housing. The bushing ring can include a radial flange

extending radially outward from the outer shoulder at one axial end of the bushing ring for engaging against one internal shoulder of the bushing housing.

[0004] As disclosed herein, there is also provided a centralizing lead screw bushing device or assembly including a bushing housing having axial ends and an opening extending therethrough along an axial axis. The opening can have a pocket or chamber extending outwardly from the axial axis within the bushing housing and have internal or inner shoulders or walls axially facing each other. A threaded nut can be axially adjacent to the pocket. A bushing or centralizer ring can be positioned within the pocket of the bushing housing between the internal shoulders. The bushing ring can have a split or gap for allowing collapsing of the bushing ring radially inward and have an inner diameter for slidably engaging an axially movable lead screw shaft extending through the bushing housing along the axial axis and also have an outer shoulder. A resilient biasing member can be positioned against the outer shoulder of the bushing ring for radially biasing the inner diameter of the bushing ring radially inwardly in a centralizing manner about the axial axis for engaging and centralizing the lead screw shaft slidably positioned therethrough for centering the lead screw shaft relative to the threaded nut for proper contact therebetween and damping noise.

[0005] In particular embodiments, the resilient biasing member can be a resilient vibration damping O-ring. The pocket within the bushing housing can have an angled internal surface which biases the O-ring both radially inwardly and axially, for biasing the inner diameter of the bushing ring radially inwardly, and for biasing the bushing ring axially against one internal shoulder.

[0006] As also disclosed herein, there is provided a method of centralizing an axially movable shaft extending within a centralizing bushing assembly. The bushing assembly can include a bushing housing having axial ends and an opening extending therethrough along an axial axis. The opening can have a pocket extending outwardly from the axial axis within the bushing housing and have internal shoulders facing each other. A bushing ring can be positioned within the pocket of the bushing housing between the internal shoulders. The bushing ring can have a split for collapsing of the bushing ring radially inwardly, an inner diameter and an outer shoulder. The axially movable shaft extending through the bushing housing along the axial axis can be slidably engaged by the inner diameter of the bushing ring. The inner diameter of the bushing ring can be resiliently biased radially inwardly

against the shaft in a centralizing manner about the axial axis with a resilient biasing member positioned against the outer shoulder of the bushing ring, thereby centralizing the shaft.

[0007] In particular embodiments, the opening through the bushing housing can include a smaller diameter hole connected to the pocket which has a larger diameter. The resilient biasing member can be a resilient O-ring. The pocket within the bushing housing can have an angled internal surface. The O-ring can be biased both radially inwardly and axially with the angled surface for biasing the inner diameter of the bushing ring radially inwardly and for biasing the bushing ring axially against one internal shoulder. The shaft can be a lead screw extending through the bushing housing and threadably engaging a threaded nut within the smaller diameter hole. Outer surfaces of the lead screw can be resiliently engaged by the bushing ring for centering the lead screw relative to the threaded nut for proper contact therebetween and damping noise. The pocket can be located at one axial end of the bushing housing. The bushing ring can include a radial flange extending radially outward from the outer shoulder at one axial end of the bushing ring for engaging against one internal shoulder of the bushing housing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The foregoing will be apparent from the following more particular description of example embodiments, as illustrated in the accompanying drawings in which like reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating embodiments.

[0009] FIG. 1 is an exploded perspective view of an embodiment of a centralizing bushing assembly or lead screw nut device.

[0010] FIG. 2 is a perspective view of a bushing or nut assembly.

[0011] FIG. 3 is a perspective view of the lead nut screw device of FIG. 1.

[0012] FIG. 4 is a schematic cross-sectional view of a threaded nut and lead screw shaft.

[0013] FIG. 5 is a sectional view of a portion of a threaded nut and lead screw shaft showing thread engagement.

[0014] FIG. 6 is an exploded perspective view of a bushing or nut assembly.

[0015] FIG. 7 is a schematic side sectional view of an embodiment of a lead screw nut device.

[0016] FIG. 8 is a schematic sectional view of an embodiment of a bushing housing.

[0017] FIG. 9 is a sectional view of an embodiment of a bushing or centralizing ring.

[0018] FIG. 10 is an end view of the bushing or centralizing ring of FIG. 9.

[0019] FIG. 11 is a schematic sectional view showing a bushing ring and O-ring assembly being inserted into a bushing housing, and FIG. 12 is a schematic sectional view after insertion.

[0020] FIG. 13 is a schematic sectional view showing a lead screw shaft being inserted into a bushing or nut assembly, and FIG. 14 is a schematic sectional view after insertion.

DETAILED DESCRIPTION

[0021] A description of example embodiments follows.

[0022] Referring to FIGS. 1-10, an embodiment of a centralizing and noise damping linear motion bushing or lead screw nut arrangement, mechanism, assembly or device 15, can include a bushing or nut assembly 20 that can be slidably and/or drivably mounted on a shaft such as a threaded lead screw shaft 4 along an axial or longitudinal axis X. The lead screw shaft 4 can be coupled to a motor as known in the art (not shown) and rotated in the clockwise or counterclockwise directions indicated by arrows R (FIGS. 3 and 7) to translate the bushing or nut assembly 20 along the longitudinal axis X forwards or backwards as indicated by arrows T. The bushing or nut assembly 20 can include a bushing housing 3 having an opening 21 extending therethrough along an axial axis A for alignment along axis X. The housing 3 can have a smaller size or diameter opening or

CLAIMS

What is claimed is:

1. A centralizing bushing device comprising:

a bushing housing having axial ends and an opening extending therethrough along an axial axis, the opening including a pocket extending outwardly from the axial axis within the bushing housing and having internal shoulders facing each other;

a bushing ring for positioning within the pocket of the bushing housing between the internal shoulders, the bushing ring having a split for allowing collapsing of the bushing ring radially inward, an inner diameter for slidably engaging an axially movable shaft extending through the bushing housing along the axial axis, and an outer shoulder; and

a resilient biasing member for positioning within the pocket against the outer shoulder of the bushing ring for resiliently axially biasing and locking the bushing ring within the pocket and radially biasing the inner diameter of the bushing ring radially inwardly in a centralizing manner about the axial axis for engaging and centralizing the shaft slidably positioned therethrough.

2. The device of claim 1 in which the opening through the bushing housing includes a smaller diameter hole connected to the pocket which has a larger diameter.

3. The device of claim 2 in which the resilient biasing member comprises a resilient O-ring.

4. The device of claim 3 in which the pocket within the bushing housing has an angled surface for biasing the O-ring both radially inwardly and axially, for biasing the inner diameter of the bushing ring radially inwardly, and for biasing the bushing ring axially against one internal shoulder.

5. The device of claim 4 further comprising a lead screw shaft extending through the bushing housing and for threadably engaging a threaded nut for disposal within the smaller diameter hole, the bushing ring for resiliently engaging outer surfaces of the lead screw for centering the lead screw relative to the threaded nut for proper contact therebetween and damping noise.

6. The device of claim 5 in which the pocket is located at one axial end of the bushing housing.

7. The device of claim 1 in which the bushing ring includes a radial flange extending radially outward from the outer shoulder at one axial end of the bushing ring for engaging against said one internal shoulder of the bushing housing.

8. A centralizing lead screw bushing device comprising:

a bushing housing having axial ends and an opening extending therethrough along an axial axis, the opening including a pocket extending outwardly from the axial axis within the bushing housing and having internal shoulders facing each other, and a threaded nut for disposal axially adjacent to the pocket;

a bushing ring for positioning within the pocket of the bushing housing between the internal shoulders, the bushing ring having a split for allowing collapsing of the bushing ring radially inward, an inner diameter for slidably engaging an axially movable lead screw shaft extending through the bushing housing along the axial axis, and an outer shoulder; and

a resilient biasing member for positioning within the pocket against the outer shoulder of the bushing ring for resiliently axially biasing and locking the busing ring within the pocket and radially biasing the inner diameter of the bushing ring radially inwardly in a centralizing manner about the axial axis for engaging and centralizing the lead screw shaft slidably positioned therethrough for centering the lead screw shaft relative to the threaded nut for proper contact therebetween and damping noise.

9. The device of claim 8 in which the resilient biasing member comprises a resilient O-ring.

10. The device of claim 9 in which the pocket within the bushing housing has an angled surface for biasing the O-ring both radially inwardly and axially, for biasing the inner diameter of the bushing ring radially inwardly, and for biasing the bushing ring axially against one internal shoulder.

11. A method of centralizing an axial movable shaft extending within a centralizing bushing device, the bushing device comprising a bushing housing having axial

ends and an opening extending therethrough along an axial axis, the opening including a pocket extending outwardly from the axial axis within the bushing housing and having internal shoulders facing each other, a bushing ring being positioned within the pocket of the bushing housing between the internal shoulders, the bushing ring having a split for collapsing of the bushing ring radially inwardly, an inner diameter and outer shoulder, the method comprising:

slidably engaging the axially movable shaft extending through the bushing housing along the axial axis with the inner diameter of the bushing ring; and

resiliently axially biasing and locking the busing ring within the pocket and biasing the inner diameter of the bushing ring radially inwardly against the shaft in a centralizing manner about the axial axis with a resilient biasing member positioned within the pocket against the outer shoulder of the bushing ring, thereby centralizing the shaft.

12. The method of claim 11 wherein the opening through the bushing housing includes a smaller diameter hole connected to the pocket which has a larger diameter.

13. The method of claim 12 wherein the resilient biasing member comprises a resilient O-ring.

14. The method of claim 13 wherein the pocket within the bushing housing has an angled internal surface, the method further comprising biasing the O-ring both radially inwardly and axially with the angled surface for biasing the inner diameter of the bushing ring radially inwardly and for biasing the bushing ring axially against one internal shoulder.

15. The method of claim 14 wherein the shaft is a lead screw extending through the bushing housing and threadably engaging a threaded nut within the smaller diameter hole, the method further comprising resiliently engaging outer surfaces of the lead screw with the bushing ring for centering the lead screw relative to the threaded nut for proper contact therebetween and damping noise.

16. The method of claim 15 wherein the pocket is located at one axial end of the bushing housing.